I/O NEWS

XXU Board
XDOS
dBIII Compiler

THE OFFICIAL PUBLICATION OF THE INTERNATIONAL ASSOCIATION OF CROMEMCO USERS

Volume Five, Number Four

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New XXU Processor Offers Enormous Speed Advantage

NEW XXU PROCESSOR OFFERS ENORMOUS SPEED ADVANTAGE

Cromemco has introduced a remarkable new processor board for its computers. The XXU, as the processor board is called, is a full 32-bit CPU utilizing the Motorola 68020 operating at 16.7 MHz and the Motorola 68881 co-processor, also operating at 16.7 MHz. The XXU provides computing speeds that are anywhere from 3 to 150 times faster than those of earlier Cromemco processors.

The enormous speed advantage of the XXU is the result of a number of important design innovations. Perhaps the most significant, after the 68020 itself, is the 16 Kbyte high-speed cache memory on the XXU. The cache uses a two-set associative architecture, and permits the 68020 to operate without wait states. The 16 Kbyte size is larger than that used in any other 68020-based computer today, and provides a big performance advantage for Cromemco systems.

Another important design consideration was placing the 68881 math floating-point co-processor on the XXU card itself, rather than on a separate co-processor card. The 68881 is an 80-bit wide co-processor capable of performing single or double precision arithmetic operations. Not only can the 68881 perform basic math operations, but it can also evaluate trigonometric functions, perform exponentiation, and it even has a stored set of twenty commonly used constants, such as *pi* and *e*. Cromemco is the first computer manufacturer to use the high-speed, 16.7 MHz, version of the 68881.

The XXU is being introduced by Cromemco almost exactly 10 years after its original processor, the ZPU, was introduced. Like the ZPU in its time, the XXU is the fastest microprocessor-based

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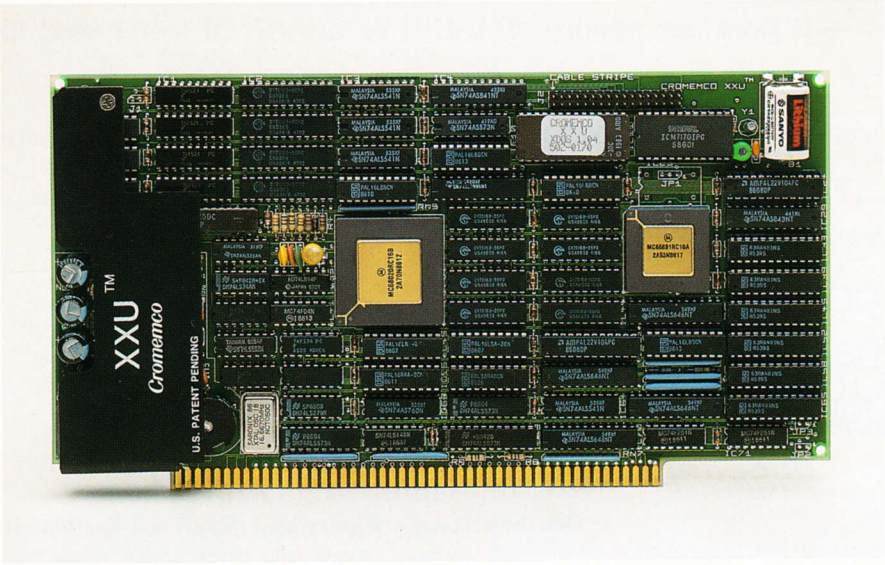

Cromix-Plus for the XXU

by Egon Zakrajsek, Ph.D.

Editor's Note:

Egon Zakrajsek *is a Senior Engineer with Cromemco, Inc.* Dr. Zakrajsek *is the author of Cromemco's highly acclaimed Cromix-Plus Operating System.*

The development of XXU Cromix, known as Series 40, began immediately after the release of Cromix-Plus version 31.05 in September 1985. It was decided that Series 40 would be developed in parallel with Series 30, with the result that except for a few routines written in assembler there is a single, common source for these operating systems and utilities. The switch from Series 30 to Series 40 is controlled by a set of conditional compila-

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Optimizing Hardware for the UNIX Environment

by Dr. Harry Garland

Editor's Note:

This paper was delivered by Dr. Harry Garland, President of Cromemco, at the UNIXWORLD Conference in Sydney, Australia earlier this year.

Introduction

When UNIX was first conceived and developed, the host computer hardware differed greatly from what is available today. One of the earliest implementations of UNIX was on a PDP-11/20 with 24K of core memory (16K for the system and 8K for the user area) and a ½ megabyte hard disk. The enormous advances in computer hardware since then have helped propel UNIX to the forefront. As UNIX has grown and developed, however, it has in turn plac-

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Convert your Z80 dBase II Systems into Multi-User 68000 dBASE III Code with

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dBIIICompiler for Cromix-Plus from WordTech Systems, Inc. has everything you need to get you up and running on the 68000 fast. dBIIICompiler is 100% compatible with your existing dBASE II DATA FILES. All you have to do is make the easy conversion of your existing dBase II programs to facilitate the power and features of the dBase III language. dBIIICompiler will then compile your systems into **MACHINE-EFFICIENT 68000 CODE.**

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Contact your Cromemco dealer for more information. If you don't have a Cromemco Dealer, contact Software Standards for the name of the dealer nearest you.

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August/September, 1986 Volume Five, Number Four

I/O NEWS

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ARTICLES & FEATURES

DEPARTMENTS

INPUT..

Editor:

As one of Cromemco's longest established dealers (1978), my experience has prompted me to comment on *Tec Tips* in *I/O NEWS Volume Five, Number Three* regarding disk partitions.

Multi-user systems, Cromix or UNIX, cannot perform with unreliable hardware or software since these systems are often running applications vital to an organization's operations such as Accounts, Database and Word Processing and the resulting down time would not be acceptable. In addition, the expertise to correct the fault is often not immediately available. Therefore, we have to work on the presumption that the system is reliable and I would recommend as few partitions as possible, regardless of disk size for the following reasons:

a) Partitioning can lead to a waste of disk space through fragmentation, i.e., four partitions each with 2Mb free, a total of 8Mb, has a file size limit of 2Mb.

b) The ftar utility allows relevant files and directories to be backed up. Operating system files and application programs only require backing up when a change is made.

c) Reloading data from tape is often a complex task since files are often inter-related. The difficulty is not reduced through partitioning.

Yours faithfully,

Andrew Smith
Managing Director
MicroCentre
Edinburgh, SCOTLAND

Editor's Note:

The following is in regards to the recent pricing/policy change made by Cromemco in regards to their Software Update Service (SUDS) program. I/O NEWS received a number of letters and calls concerning this; one which expressed the general sentiment appears below. Following it is a reply by Ted Maciejewski of Cromemco.

SUDS Subscriptions — A Good Buy?

While many other companies offer updates of their software on a "per-update" price scheme, Cromemco has always offered updates to their customers on a subscription basis. Until recently, any licensed customer could subscribe to Cromemco's "Software Update Service' (SUDS) for $95 (most packages) and receive a year's worth of updates. I have always been a little disappointed with this arrangement, but I frequently subscribed because I could wait until I actually NEEDED the update, then visit my dealer to see it work before I paid the fee. That way I was sure of what I was getting.

Now, I do not believe that a company should ethically make a lot of money off of updates. After all, the reason most customers order updates is to either:

1) get rid of bugs that shouldn't have been there in the first place.

2) support new hardware that they already paid a lot of money for.

Therefore, software companies should charge a modest update fee to cover the costs of the new documentation, the disk, the mailing, and the bookkeeping.

Ninety-five dollars was a little bit more than I liked to pay for a single update. At one time, I was offered an update to Supersoft's C Compiler for $50. I also bought an update to Digital Research's PL1-80 Compiler for $75. Cromemco's SUDS fee was a little bit higher, but there was always the chance of getting that second (or third) update during the course of the year. So, I felt that it was a reasonably good deal.

However, a few weeks ago I received a letter from Cromemco stating that the update subscription price has been raised to $295 for most packages for a period of 2 years. That works out to $147.50 per year, which is a 50% increase. Can Cromemco really claim that the cost of providing these updates has gone up that much? No, they are clearly trying to make a profit on updates. One should also realize that many of these packages sold for as low as $425 (from discount houses) in the first place.

I also feel that two year subscriptions are too long. The customer still has no guarantee of how many updates he will be getting (although I assume that Cromemco will continue to provide at least one update during the subscription period). He also has no guarantee as to what he will be getting with each update, or even if he will need those updates in the first place. Software subscriptions, especially these long two year subscriptions, deny the customer the right to know what he is buying. Cromemco should go back to their one year subscription time, or preferably a "per update" pricing scheme.

Lastly, I want to point out that this new SUDS subscription rate is going to be bad for Cromemco dealers. I am no longer a dealer, but I used to discount older software packages $95 so the customer could use that money to buy a SUDS subscription. That way I could sell software packages with older version numbers. However, it is impossible to discount a package $295 without losing money on software. Perhaps Cromemco should devise a scheme to help its dealers update their old software stock. I, myself, have had over $1500 worth of software sitting on my shelf for the past two years now (a list will be provided on request).

I urge every reader and dealer of like mind to voice their own opinion to Cromemco.

Robert Staudenmaier
Goleta, CA

Dear Mr. Staudenmaier:

Your letter titled "SUDS SUBSCRIPTIONS — A GOOD BUY? " was forwarded to my attention and I will try to clarify Cromemco's position with respect to the recent price and policy announcement. Although this letter may not change your feelings about SUDS, I certainly feel that the price increase is justifiable.

I would first like to point out that when Cromemco started the SUDS program (1981), it was not intended to be a profit making operation but simply a "break-even" service. During the past five years some software packages continue to get larger and more complex while others required more in-depth documentation. It wasn't too long before the SUDS department became a liability.

With the rate change came a corresponding change in policy. We realized that the amount of increase was

substantial and for that reason we implemented the following change:

"If no updates are generated during the original two year term of your subscription Cromemco will extend your expiration until an update has been generated or for another TWO (2) years, whichever is the lesser, at no additional costs."

I would concur that it would be more desirable to receive at least one update a year but that isn't always the case. The value of the above statement can therefore reduce your exposure over the term of the agreement to a rate of $87.50 per year. Although prices were held constant since the 1981 origination date, this increase is equivalent to an annual amount of 13% per annum since 1981.

As technology changes, software also evolves and in some cases becomes outdated. This can be exemplified very simply by the evolution of the processor chips used by Cromemco (Z80 to 68000 to 68010 and most recently the 68020). This generated a number of changes in operating systems, some languages and applications. Will all the software packages require updates? Probably not, since some packages work through emulators and will work as normal, while others may not be capable of being updated.

SUDS is an individual choice that must be weighed against the needs of the user. In essence it is a type of INSURANCE that IF a change (whether a fix to a bug or an enhancement to the performance) is made to the software, what impact would it have on your operation if you didn't receive the update? As you pointed out, in some cases when no updates are expected within a year it may be cheaper in the long run to take a chance and buy a new package after an update has been released.

Cromemco is simply providing the service, it is up to you as the User to determine your own needs and requirements. Cromemco places a high regard on the views and opinions of its customers and hopes this memo better explains the reasons necessitating the pricing change. If you have any further questions please advise.

Sincerely,

Ted M. Maciejewski
Manager, Systems Engineering
Technical Service
Cromemco, Inc.

Editor:

Thank you kindly for you recent letter which was waiting for me when we returned from vacation.

My reason for writing is release 2 of Structured Basic (version 2.06) which arrived while I was gone. I had purchased the 68000 Structured Basic as soon as it was announced and soon discovered some bugs and deficiencies. The deficiencies included the fact that I was not able to drive my plotter, since no provision was made to add drivers. The main bug was that although the description of the DIMENSION statement said that you could have values as high as 16382 it turned out that dim x(8900) or dim y(20,20,20) gave ERROR 13 — Invalid dimensions regardless of what size the SBASIC68 for which it was configured.

It happens that I called Cromemco and ended up talking to Dr. Roger Melen. He asked me to document the difficulties and write them for him. This was done in January or February 1985. He wrote to me shortly thereafter and indicated that my bugs were "honest bugs" and that they hoped to have an update in the fall of 1985.

Earlier this year my dealer obtained for me a beta test copy which turned out to be version 2.01. Again I found that the problem with the DIMENSION statement existed and gave the same results as a year and a half ago. The problem with the drivers was fixed in both 2.10 and 2.06 and I had no difficulty in implementing a driver for my plotter (and probably will be able to for other equipment that I have).

I made every effort to communicate the problem in version 2.01 through my dealer and directly, so it came as a big disappointment that version 2.06 still behaved in exactly the same manner when it came to the DIMENSION problem.

It seems very difficult to get anyone at Cromemco to listen to what you are saying. From the information that my dealer was able to get, it appears that Cromemco had a great deal of difficulty in getting the 68000 version implemented.

The notes which came with release 2 had some minor errors, but it also refers to modifying KFORM for non-Beehive terminals (page 11 023-9647 03.20.86 REV A). The comments seem to fit Z80 Structured Basic, but as far as I know the KFORM was never released for the Z80 version (I can't find anything on my Z80 disk at any rate). Also I have not found anything in the SBASIC68 disk which permits such a change. SBASICIO.ASM calls an extern cset which is commented as console special function, but there is no source provided for this routine as near as I can tell.

I have written to Dr. Melen about these two problems, but any help you can give or any information about who to contact will be most appreciated.

Your work on the *I/O NEWS* is of high quality and most appreciated.

Best wishes to you and Lisa.

Don Madsen, P.E.
Consulting Engineer
1315 Whiting Avenue Court
Iowa City, Iowa 52240

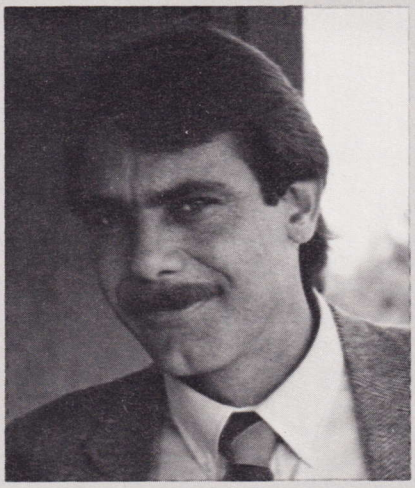
On behalf of Lisa and myself, thank you for the compliment regarding I/O NEWS. Although I have not personally used the 68000 Structured Basic, and therefore cannot directly substantiate the bugs you have encountered, I can sympathize with your predicament. Since dimensioning of variables in Basic is such a commonplace and necessary function, it seems inexcusable that such a problem was not detected early on in the development phase, and quickly corrected.

You alluded to the fact that Cromemco has encountered difficulties in getting the 68000 version implemented. To this I can personally attest. However, it is quite understandable in light of the fact that the development of the 68000 Structured Basic was not done by Cromemco; rather, it was a project carried out by a Swedish firm, Datorisering AB. The wheels of progress turn slowly, and even more so when the train of gears are separated by a vast expanse of ocean.

There follows the address, and person to contact regarding the deficiencies you have noted. But be forwarned — you may not get a response. I have written a number of letters requesting information on the 68000 Structured Basic and other projects that they are working on. None of them have been answered. Still, it never hurts to try (as I will continue to do). So if any others of you have encountered deficiencies in the 68000 Structured Basic, let Cromemco know, but also write to the following company that was responsible for the design and development of this product:

Datorisering AB
Attn: Valter Wickberg
Box 510, Fribergavagen 7
Danderyd, 18215
SWEDEN

OUTPUT...



Bill Jaenicke

It's always exciting when something that once appeared hazily on the horizon looms into clear focus. And as attested to by this issue, that is what has happened with R&D and manufacturing at Cromemco. The 68020-based systems are here!

I/O NEWS is proud to be the first to make this announcement to the world at large. And to do it in a big way. For we have the rare opportunity to give you the facts straight from the source — the engineers that were responsible for developing the boards and the software that will play such an important role in bringing Cromemco's so called "micro" computers into those arenas that have heretofore been the exclusive domain of minis and mainframes.

Ed Lupin, designer of the XXU card, gives you an inside look at this bold new product. The powerful capabilities of XDOS, the new diagnostic and bootstrap program for the XXU, are explored by its designer, Herb Lewis. And Dr. Egon Zakrajsek, the developer of Cromix-Plus, shares his insights into the features of the new series 40 Cromix-Plus for the XXU. To round things out, Dr. Harry Garland, President of Cromemco, provides an overview of Cromemco's design philosophies and tactics in optimizing their hardware for the Unix environment. As you will see, the new 68020-based systems are more impressive than ever imagined.

On the home front there have been a number of new developments. For one, there is a new addition to the I/O NEWS staff — but you'll have to read the NEW PRODUCTS section for that.

Also, our System 100 has a new device: a Hayes Smartmodem 1200. So now we'll be able to receive calls as well as initiate them. If you have something you want to send to us over the modem give us a call at the office for details.

The next issue will have some new offerings. For one, the return of SOFT TIPS. Long-time I/O NEWS contributor,

Lisa B. Jaenicke

Robert Brown, of Excalibur Computers, will take the helm for that popular column. And for the Unix and Cromix programmers there'll be something new: a column called SOFT TOOLS, which will be put together by programmer extraordinaire, Tom Ronayne, of Advanced Programming Techniques. His first installment will cover a topic dear to every computer user — strategies for backing up your valuable computer data.

Enough said. I'm sure you're eager to get into the issue. Enjoy.

Bill Jaenicke
Editor

Software Review: dBIII Compiler

Editor's Note:

The following evaluation of the Software Standards Inc. port of dBIII Compiler (by WordTech Systems, Inc.) was written by Charles Perrella and Jeffrey Walker of Trexis Inc., 45 F Route 303, Valley Cottage, NY. 10989, (914) 268-5161.

Our firm has been waiting for a multi-user environment for dBASE II or dBASE III that would run under Cromix-Plus. For those of you who have also been waiting, **dBIII Compiler** might be the answer.

Cromix-Plus is a terrific operating system. dBASE II and III are very good relational data base managers with a built-in programming language that makes software development quite easy. Neither dBASE II or III have multi-user capabilities, while Cromix-Plus has built-in record level locking. Ashton-Tate seems to have no plans to alter their packages for the Cromemco users running Cromix-Plus. Informix and Unify are the only two powerful, relational data bases available for Cromemco users. To take full advantage of these packages the C language must be used. Although the C language is very powerful, one can write applications much faster in dBASE. An alternative is WordTech's dBIII Compiler ported to Cromix-Plus by Software Standards, Inc.

dBIII Compiler is a compiler that takes advantage of both worlds: Cromix-Plus' multi-user capabilities and the ease of dBASE.

Both compiled languages (C, FORTRAN, COBOL) and interpreted languages (Basic, dBASE II and III) have their advantages and disadvantages. If you are not familiar with the differences between the two, suffice to say that the interpreted language is usually easier to use while the compiled versions are faster and do not require a copy of the original software for every user.

In this case, dBIII Compiler adds multi-user capabilities, such as record level locking and spooling, not found in dBASE II or III. It is written expressly for the Cromix-Plus operating system and runs on the 68000 processor. These features alone make it a must for every Cromix-Plus user to consider purchasing. If you are presently using dBASE II, which runs under the simulator, your programs will run faster using the dBIII Compiler. In addition, general system speed with a number of users on the system is greatly increased over dBASE II. Software developers should consider the ease of writing dBASE III code and the security of binary files for their final product.

The package comes with a demo disk set and the main package disk. A purchaser has the chance to try the demo disk before breaking the main seal. The manual says the package may be returned as long as the main seal is not broken. An unspecified handling charge is mentioned in the manual for returning the package. The demo disks allow full operation of the compiler for a limited number of records (15).

The manual is easy to follow and is quite direct in leading one through the startup and system requirements. Memory per user is adjustable and the manual lists 18 different schemes from 220K to 360K per user. In addition, the manual clearly states which dBASE III commands are not supported (more about this) and which commands have execution differences. The manual is 159 pages in a loose leaf binder.

Another advantage of dBIII Compiler is its use of the termcaps file under Cromix-Plus. This gives the end user flexibility in being able to run the same software from a variety of terminals with no modification.

To evaluate this package, we wrote a complete business operation with it. This included data bases for customers, inventory and prices, an order entry system, a billing system, an accounts receivable system, a shipping and tracking system, salespersons commissions, sales analysis, production analysis and scheduling. All programs were written with Screen editor and then compiled and linked using the dBIII Compiler package.

The ability to have record level locking in this application was a necessity. The dBIII Compiler packages offers a number of record level locking options. The default is an automatic lock whether the record is being read or updated. A second option locks the record only on update and informs the user if there is a problem. The third option locks the record only on update and aborts if there is a problem. The last two options require some special coding in the application. The manual mentions future releases will include syntax for the programmer to manipulate record locking.

We have not experienced any apparent failure of the record locking scheme. However, users should be aware of two points. When a file is first opened with the USE command, this package, as does dBASE III, sets the record pointer to the first record. If nothing is done by this user and another user comes on the system and issues the USE command for the same .dbf file, the second user is denied access as he/she is also trying to set the pointer to the first record. The first user must move off the first record in order for someone else to be allowed to issue the USE command in that database. Second, when a record is automatically locked using the default option, no message is sent to the next user trying to select that record. There is just a pause. Some sort of built-in message would have been a better idea. There is the ability to manipulate a memory variable with the second and third locking schemes, so messages could be provided by the programmer.

As this is a compiler, certain interactive commands cannot be supported:

Append (Append Blank is), Assist, Browse, Change, Create, Dir, Display Status, Edit [#], Help, Insert [Before], List, Status, Modify, Set (carry, debug, echo, heading, help, menu, path, safety, step, talk)

There is a programming solution for each command not supported. In addition, certain commands are not supported because "This interactive command would be dangerous in a compiled application, by enabling the application user to modify data without guidance from the programmer." We don't entirely agree with this statement. Certain commands not supported would be useful to the programmer.

The package contains its own create utility, which is a one shot deal. No editing is allowed when you create a data base. We moved around this weakness by using Screen to create our data base layouts (with all of its fine editing) and then redirected the file as input into the Create Utility.

We have written a universal utility in dBIII Compiler code that simulates some of the non-supported commands. There is even a feature in our utility that simulates the famous "." prompt for some interaction. We wanted just a little more flexibility that the package allowed, and intend to follow with future articles demonstrating these techniques as we gain more experience with dBIII Compiler.

The authors of dBIII Compiler have added some additional features not found in dBASE III. One of the nicest is the ability to send formatted output

Continued

dBIII Compiler

Continued

to a text file. Also, printing is handled through the Cromix Spool Utility. However, it would have been better if the ability to specify which printer was to be spooled was added. Now, the package spools to the default of the Spool Utility, /dev/prt. One can get around this weakness by some intelligent writing of Cromix command files.

Set commands have been added to manipulate paths, time, formfeeds, and a scheme is added to input and output directly to devices. In addition, Environmental Variables for passing arguments from the run-time command line to the executing program have been added.

The manual states that both the .dbf files and .ndx file used with dBIII Compiler are completely compatible with dBASE III. If you have an MS-DOS machine on your Cromemco, as we do, this will give you extended flexibility. There are some good packages available to allow the transferring of data from Cromix to MS-DOS.

By the way, for you MS-DOS diehards, we ran a benchmark between an application in dBASE III on an MS-DOS machine and the same application in compiled dBIII Compiler code running under Cromix. The program manipulated serial files and wrote a one meg text file to the respective machines hard disks. The dBASE III under MS-DOS took one hour and five minutes, while the dBIII Compiler compiled program under Cromix took 33 minutes!

The first two versions of dBIII Compiler provided by Software Standards, Inc. contained some problems. On uncovering these problems, our calls to Software Standards Inc. were handled quickly and corrected versions were sent promptly.

In summary, this is a well-designed useful package. Each dBASE II and III user must however decide for themselves whether the reprogramming necessary to replace unsupported commands and the lack of the interactive mode makes up for the increased speed and record level locking multi-user capability. We found our conversion and development efforts well worth it. Application programmers currently writing for Cromemco systems in Structured Basic, C, etc. should seriously consider this package. One can write dBASE III type code much faster! In fact, the time you save in writing code can be used to write articles for I/O NEWS!

The XXU

Continued from front cover

CPU card available from any manufacturer today.

The Whetstone benchmark test can be used to see the enormous computing power now available from Cromemco systems with the XXU. As shown in the table, the original ZPU performed 7,000 Whetstone tests per second. The second-generation DPU performed 40,000 Whetstones. The third generation XPU performed 50,000 Whetstones alone, and 300,000 Whetstones with the Maximizer co-processor. The fourth generation XXU now performs 1,050,000 Whetstones per second. This is 150 times faster than the original ZPU!

In addition to astounding speed, the XXU has a number of convenient features. A real time, battery backed up clock/calendar is included on the XXU card. No longer do you need to set the time and date at log in; now the computer knows! A special lithium battery cell is included on the XXU card for the clock/calendar. The battery needs to be replaced only once every seven years.

The XXU also has a diagnostic/boot ROM containing a program called XDOS. XDOS serves the function formerly performed by RDOS in the 64FDC. By including the diagnostic ROM on the XXU, it is the only card in the system that need be functional in order to run diagnostics. Any failure of the XXU card itself is indicated by a red, fault-detect LED on the XXU card. Other features of XDOS are described in an accompanying article by its developer, Mr. Herb Lewis.

The XXU is first being introduced by Cromemco in its CS-400 chassis. The new system is called the CS-420, and is now clearly the flagship of the Cromemco line.

Cromemco systems in the field can also be upgraded to the XXU. In XPU-based Cromix systems, the XXU simply replaces the XPU card. A small modification must be made to the STDC card (converting it to a STDX) in order to work with the higher-speed processor and, if error-correcting memory is used, a small modification must be made to the MCU card as well. The Octart, Biart, and memory cards require no modification. For UNIX systems, the XMM must be replaced with a new, higher-speed memory mapper, the XMU.

New versions of Cromix Plus and UNIX have been developed for the XXU. UNIX is now based on AT&T version V.2 and fully supports virtual memory. The new version of Cromix Plus is described in an accompanying article by its developer, Dr. Egon Zakrajsek.

Since the 68000 and 68010 instruction set is a subset of the 68020 instruction set, most DPU or XPU based software can be run without modification on the XXU. Such unmodified software will typically run three times faster on the XXU than on the XPU. To take full advantage of the 68020 instructions set and the 68881 co-processor, however, programs must be recompiled. For this purpose, Cromemco has released new editions of Fortran 77, Pascal, C, and Basic that produce code which is optimized for the XXU environment. Such optimized code can run from 3 to 20 times faster on the XXU than on the XPU.

The XXU may well be the most significant product in the history of Cromemco. It is an incredibly high performance card. A team of over 20 engineers at Cromemco worked on the XXU and related hardware and software projects. In special invited papers, three of the key engineers on the project, Ed Lupin, Herb Lewis, and Egon Zakrajsek, describe the XXU and its capabilities in more detail in this issue of I/O NEWS.

TABLE

PROCESSOR	WHETSTONE PERFORMANCE
ZPU	7,000
DPU	40,000
XPU	50,000
XPU AND MAXIMIZER	300,000
XXU	1,050,000

WHETSTONE BENCHMARKS

The following are Whetstone benchmark results, in Whetstones per second. The Cromemco CS-420 was operated with the XXU processor and version 1.0 of Cromemco's 68020 Fortran compiler. Data were obtained from Datamation and Unix World magazines.

MANUFACTURER	MODEL	WHETSTONES
CROMEMCO	CS-420	1,050,000
DEC	MICROVAX II	877,000
SUN	3/50	860,000
APOLLO	3000	780,000
DEC	VAX11/780	476,000
IBM	PC/RT	200,000

DHRYSTONE BENCHMARKS

The following are Dhrystone benchmark results, in Dhrystones per second. The Dhrystone benchmark forms a complement to the Whetstone suite (number crunching) and provides a measure of overall system performance (processor speed, disk and terminal I/O, etc.). The Cromemco CS-420 was operated with the XXU processor and version 1.0 of Cromemco's 68020 C-compiler. Data was obtained from the UNIX USENET study.

MANUFACTURER	MODEL	DHRYSTONES/SEC
CROMEMCO	CS-420	3703
CELERITY	C-1200	3468
PYRAMID	90x	3333
DEC	VAX 11/785	2136
GOULD	PN6005	1964
HP	HP 9000-500	1724
AT&T	3B20	1724
APOLLO	DN660	1666
DEC	VAX 11/780	1662
DEC	MICROVAX-II	1612
IBM	PC/RT	1333
IBM	PC/AT	1315
AT&T	3B2	1315
PLEXUS	P/60	1163
DEC	VAX 11/750	1091
ALTOS	586	793
ONYX	C8002	511
IBM	PC/XT	427
IBM	PC	390

XDOS: The Diagnostic and Bootstrap Program for the XXU

by Herb Lewis

Editor's Note:

Herb Lewis is a Senior Engineer with Cromemco Inc., and is the author of XDOS for the new XXU card.

Introduction

It has been close to a decade since Cromemco first introduced RDOS, a 2K-byte program which contained the initialization and bootstrap program for Z-80 based CDOS systems with a 4FDC. Now we are proud to introduce its successor, **XDOS:** a 64K-byte program for 68020-based Unix and Cromix systems. XDOS incorporates features which have been suggested by Cromemco users worldwide, some of which include:

- Automatic self-test of CPU and RAM before boot
- LED display of system malfunction
- Flexible console handling
- STDC hard disk exercise capability
- Provision for remote diagnostics

These and other features are described in more detail below.

Starting the Diagnostics

XDOS begins operation by performing a checksum comparison on the ROM, followed by a test of the external cache and lower 128K of RAM. If the RAM tests good, XDOS is moved into RAM and continues executing. If RAM is bad but the external cache tested good, XDOS sets up the external cache for its RAM and continues executing from ROM. This allows a technician to use the facilities of XDOS to debug the RAM problem. The console device is then checked and initialized if present. If XDOS cannot establish communication with the console device, the diagnostic LED is used to indicate the problem by blinking a pattern of long and short blinks described below:

BLINK PATTERN	MEANING
STEADY ON	CPU not functioning
L L L S	ROM checksum failed
L L S L	Both external cache and 128K RAM failed
L L S S	Cannot initialize console

If there is no console communication and no blink pattern is detected, then the source of trouble is in the console link (e.g. no terminal is connected or the baud rate is improperly set).

Selecting the Console Baud Rate

XDOS will determine the baud rate of the console device as follows:

1. FDC with switch 1 on (ROM preset baud rate)
2. RTC RAM selection (RTC RAM preset baud rate)
3. FDC (auto baud rate)

The baud rate for the various cases above is selected in the following manner. For case 1 (ROM preset baud rate), the last byte of the XDOS EPROM is used as a flag to choose the baud rate. For case 2 (RTC RAM preset baud rate), one of the bytes in the RTC alarm RAM is used as a flag to choose the baud rate. For case 3 (auto baud rate), a break character is sent and the FDC scanned at various baud rates until a carriage return is detected. Baud rates of 19200, 9600, 4800, 2400, 300, 150, and 110 may be detected.

The devices that may be selected for the console through the RTC RAM selection are the FDC or Octart with new firmware. The Octart may be selected as channel number 0 through 63 which represents channels 0 to 7 on eight different Octarts at base addresses CEh, D0h, D2h, D4h, D6h, D8h, DAh, and DCh.

Booting the Operating System

XDOS will allow automatic boot from 16 devices based on the value of the switches on the FDC or the value specified in the RTC RAM console selection entry. Any other device may be booted by issuing the boot command followed by the device name. ESCAPE may be used to cancel the preset boot device.

Diagnostic Tools

XDOS has commands for manipulating memory (display, substitute, move, search, compare, and fill) as well as I/O space (examine and output of both external I/O and internal XXU I/O space). Arithmetic calculations may be performed, memory tests performed, and user routines executed (with the GO command). Floppy disks (both Cromix and Unix style) and STDC hard disks may be tested, sectors read and written, and tracks read and written.

Flexible Input Format

Wherever a numeric value is expected, a decimal integer may be specified by following the number with a decimal point (e.g., 123.). If no decimal point is present, the number is assumed to be hexadecimal. Numeric input may also be arithmetic expressions using multiplication, division, modulo division, addition, and subtraction with parenthesis to alter the normal precedence of the operation.

Console input is line buffered, allowing use of the following editing commands:

Backspace or
Backarrow or
Delete or
Rubout Deletes previous character
Control-U Deletes line

Control-S may be used to suspend display output, with Control-Q used to resume display output.

Escape or Return may be used to abort the display and return control to XDOS.

Advanced Diagnostics

Special purpose diagnostic programs or stand-alone utility programs may be loaded (replacing XDOS) from floppies, hard disk, or any of the serial channels including the console. These programs have a special format which includes a CRC value for the code which insures the program was loaded correctly before XDOS is replaced. This feature would allow programs to be loaded over a phone by connecting a modem to the desired serial channel. It is also possible to store custom diagnostic programs in the upper portion of the XDOS ROM, where space has been reserved for this purpose. This allows OEMs and others to add specific tests for their system configuration. These tests may be invoked by using the XDOS GO command.

The XXU Board

by Ed Lupin

Editor's Note:

Ed Lupin is a Senior Engineer with Cromemco Inc., and is the designer of the new XXU card.

Cromemco's **XXU** processor board provides a bold leap in microcomputer processing power, exceeding previously offered microcomputer speed by a factor of three or more. By integrating a 16.7 MHz MC68020 microprocessor, a 16.7 MHz MC68881 floating-point coprocessor and a 16 KByte two-set associative data and instruction cache onto one S-100/IEEE-696 card, the XXU offers performance heretofore unavailable in a general purpose microcomputer. Using Cromemco's 2048KZ memory boards, which feature Cromemco's exclusive double-word (32-bit) transfer extension to the S-100/IEEE-696 bus, data can be moved on the bus at rates as great as 8.33 megabytes per second. This is more than double the transfer rate of previous Cromemco products.

The MC 68020 provides a much more powerful instruction set than found in the MC68010/68000. The new C, Pascal and Fortran compilers take full advantage of such improvements as 32-bit offsets, and a new indexing mechanism, where a data register can automatically be multiplied by two, four or eight before use as an index.

The MC68881 floating-point coprocessor is tightly coupled with the MC68020 so that the floating-point instructions can be used as if they are native instructions of the MC68020 processor itself. The MC68881 computes in hardware single and double precision addition, subtraction, multiplication and division, as well as a host of more complex calculations such as exponentiation, trigonometric functions, hyperbolics, etc. All floating-point operations conform to the IEEE standard. The performance of the XXU has been measured in excess of 1 MILLION Whetstones per second!

Because the MC68020 requires data at a much faster rate than a bus-based system can provide, it is imperative to provide a zero wait-state storehouse of locally available data. In order to achieve highest performance, this local storage area (cache) must contain instructions and data that the processor is likely to reuse. The cache is filled automatically as the program executes. By tracking the data's source location in main memory, it is possible to load the cache with instructions and data from many different places in main memory. This enables cache operation to be completely transparent to the user, except for the dramatic increase in processor performance.

Additional enhancement is achieved by a feature called "quick-write." When the MC68020 performs a write cycle, the status, address and data to write to main memory is saved in registers external to the processor and the MC68020 write cycle is terminated. The XXU state machine completes the write cycle to the S-100 bus, while the MC68020 continues execution from its internal cache or from the on-board external cache. By paralleling bus operations with cache, ten or more instructions can be executed in the time that would have been wasted had the MC68020 waited for the S-100 write cycle to be completed.

The XXU also provides a real-time clock/calendar with battery backup and a diagnostic/boot ROM. The clock has an accuracy adjustable to within seconds per month. The combination of battery backup and high degree of accuracy eliminates the tedium of entering time and date every time the system is booted. The diagnostic/boot ROM makes it possible to test the basic system hardware prior to booting. This enables configuration or hardware problems to be detected and signalled to the user via the LED.

The XXU is designed to be compatible with most of the existing Cromemco S-100 boards. Bus timing constraints are actually slightly relaxed when compared to the XPU. The state machine on the XXU automatically compensates for MC68020 data requests for data widths greater than the addressed slave device can transfer. If a long word transfer is attempted with a word-wide device, the state machine causes two word-wide bus cycles to take place. Four bus cycles would be performed for byte-wide slave devices. Thus a programmer need not be concerned with the width of the slave device being addressed.

The XXU makes supermini performance available to customers at a fraction of the cost. Thanks to state-of-the-art VLSI technology combined with computer-aided-design for printed circuit board artwork creation, Cromemco brings to the microcomputer world a computer system of unprecedented capability.

BITS & BYTES

BITS & BYTES is the place to look for the odd bit of information, opinion, programs, profiles and rumors that circulate through The IACU. Our ears are always attuned to any interesting miscellany — if you have something to contribute send it along to I/O NEWS • P.O. Box 17658 • Irvine, CA 92713 • (714) 661-9764

KERMIT

The following information appeared in the Cromemco Users' Newsletter No. 14:

A considerable number of Cromemco users (not all of them CUG readers have asked for copies of the file transfer software known as KERMIT. Two versions for Cromix are available, one written in Z80 (from Sean O'Leanachain, UCG, Eire) and the other in 'C' (from Ian Golding, VSL, Berne, Switzerland). Copies have now been widely distributed and hopefully are working satisfactorily. There is also an IBM-PC Kermit (Peter Norman, University of Newcastle on Tyne) and one for UNIX (from Peter Winship, Edinburgh). Ian Golding has asked particularly that those who have received the server kermit in 'C' from VSL should contact him if they have not already done so and let him know how it worked and if there were any problems. Addresses follow:

S.P. O'Leanachain, Data Proc. Dept. University College, Galway, Ireland

Ian Golding, Losinger Ltd., Konizstrasse 74, CH-3001, Berne, Switzerland

Peter Norman, Dept. Chem. Eng., University of Newcastle Upon Tyne, England, NE1 7RU

S-100 Journal

In case you haven't heard, there is a new publication which is devoted to S-100 systems and is called *S-100 Journal*. To date there has been very little in the way of information regarding Cromemco systems, but that should be changing in the future as Cromemco and Cromemco users start contributing articles and news releases. The magazine provides an open forum for discussion among S-100 users and is refreshing in light of all the PC-oriented magazines that abound. What is more, it's relatively cheap at $14 per year. For more info contact:

S-100 Journal
P.O. Box 12881
Raleigh, NC 27605

New I/O NEWS Binders

We now have in stock binders for *I/O NEWS Volumes V and VI*. They're D-ring, burgundy in color, and sport the new logo in white — very attractive. So if you want to keep your collection of I/O NEWS in pristine condition, and easily accessible, order now. The cost is only $10 which includes first-class shipping in the U.S., Canada and Mexico. International orders should include an additional $5 for surface shipping (allow six to eight weeks). If first-class shipping of International orders is desired, please specify — you will be invoiced for the cost.

PD Bios & Bootstrap?

IACU member Al Kline believes that there is a public domain version of the BIOS and Bootstrap programs for CP/M with the 16FDC, but has been unable to locate it. If any of you can help contact him at:

Al Kline
ARTEK Systems
170 Finn Court
Farmingdale, NY 11735

Special Offer!

EXCALIBUR COMPUTERS and I/O NEWS have made an arrangement that could save some of you some money. To wit, if you renew your subscription to I/O NEWS before the next issue is mailed you become eligible for a 40% discount on the memory board upgrades offered by EXCALIBUR (see ad on page 24). This is a limited-time offer and is good only until Volume V, No. 5 is published. EXCALIBUR will be provided with the names of those of you that renew during this period. So even if you are not due to renew yet, you might want to do so ahead of time and take advantage of the savings in a memory upgrade.

CP/M Users Unite!

We have received some criticism that I/O NEWS does not offer much for the CDOS and CP/M users. Admittedly,

most editorial deals with Cromix and Unix — the reason being that that is what is being contributed by our readers. We would be more than happy to publish more regarding single-user operating systems if we were to receive such articles or notes.

Using the CTD

Editor's Note:

The following is reprinted from the May/June issue of Cromemco's NEWS for ISO's and OEM's.

It is essential that proper operating procedures be used with the CTD tape drive to assure proper operation. First it is essential that the tape head be cleaned regularly using the following materials and procedure:

Materials:

- Clean 6 inch lintless swabs
- IBM standard/equivalent head cleaning solution, or isopropyl alcohol may be substituted.

Procedure:

1. Remove tape cartridge from drive.
2. Execute shutdown and turn off power to system.
3. Dampen swab head with cleaning solution. Do not load swab with excess cleaner.
4. Locate the tape drive's metallic silver read/write head about 3 inches in the drive on the right hand side.
5. Swab the head until clean, being careful not to apply excess cleaner to adjacent parts.
6. Remove all cleaner residue before insertion of tape cartridge, and restart system.

Secondly, please note that the 30.79A version of Cromix-Plus, and later versions contain expanded versions of the mode and inittape utilities. These utilities have also been integrated into Cromix-Plus version 31.05. The proper use of these utilities has been found to greatly increase the reliability of tape backups.

Inittape, version 30.08 or later, has the ability to verify after initializing. In this process, it detects bad sectors and automatically writes them to a Volume Table of Contents (VTOC). The VTOC is read by the tape writing utility (rcopy or ftar), which skips those sectors. There is a -p option which allows the user to change the number of verifications from the default of three (3) to another number. Mode version 30.22 and later has the ability to report or set various floppy tape parameters. Those parameters which are of particular interest here are VERIFY, RETENsion, and RETRY. we have found that if the following procedure is followed, the floppy tape drive will perform reliably:

1. Initialize the floppy tape with inittape, version 30.08 or later. The default number of verification passes is 3; we have found that setting this value to 1 decreases the time required to initialize tapes from 40 minutes to 20 without degradations of reliability. The proper command line to do this is:

```
inittape -fv -p 1 ftcd
```

2. Use mode ftcd to set the following floppy tape parameters: (a) verify, (b) retension 0, (c) retry 10. The command line to do this is:

```
mode -v ftcd verify reten 0 retry 10
```

3. Execute the following command lines to copy and check a partition:

```
rcopy -t /dev/devname /dev/ftcd
rcopy -tc /dev/devname /dev/ftcd
```

4. When accessing a tape which has not been read or written to for several hours, even though it has been in the system, occasional read/write failures are eliminated by a retensioning of the tape. This can be accomplished by opening and closing the tape drive door, or executing the following command:

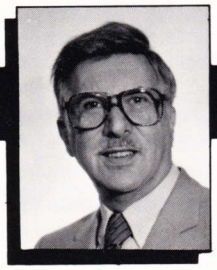
```
mode ftcd reten 0
```

5. In most cases the above procedures will result in a successful backup. In some instances, however apparently due to marginal tape media, which has been improved by the manufacturer, it may be necessary to change the above floppy tape parameters to the following extreme case values to successfully copy to tape.

For the extreme case, e.g., a very old tape, where the previous settings are not sufficient to successfully make a backup, execute the following command:

```
mode -v ftcd verify reten 30 retry 70
```

The above information should enable the user of 30.79A to reliably back up a system on cartridge tapes using rcopy. Version 31.05 of Cromix-Plus includes an excellent tar utility called ftar. This allows the user to backup on a file by file basis, or to backup selected files (such as only those modified since the last backup), or make large backups spanning more than one tape cartridge. Full information will be found in the ftar "help" file.



INSIDE CROMIX

INSIDE CROMIX is an open forum on both eight-bit and 16-bit versions of Cromix. The subject matter is directed towards helping Cromix users derive more from their systems. Members' contributions are invited. INSIDE CROMIX is edited by Jordan Siedband, who can be reached at 5017 Fairview Lane, Skokie, IL 60077, (312)674-1175.

In a previous *I/O NEWS*, I declaimed the lack of access to the termcaps routines by the 'C' Programmer. Cromemco sent me a preliminary copy of CROMIX-PLUS version 31.24 which has, among other things, a new version of syslib.obj to be used when linking 'C' programs. This version of syslib.obj contains the exact functions I was seeking!! The UNIX programmer will recognize the corresponding UNIX termcap calls immediately.

NOTE:

The reader should familiarize himself with termcaps by typing:

help termcaps

and (for the correct order within termcaps):

help ce

Notice that the capabilities are broken into 3 types: str, boolean, and num. For example, cl should be the screen-clear string for all terminals. It is of type string. The following ideas should be incorporated into your programs to make them as useful as possible.

```
#define MAXSIZE  40
char    *termfile="/etc/termcaps";      /* full pathname for termcaps    */
char    term[1024];                     /* termcaps buffer string        */
char    buff[MAXSIZE];          /* your working buffer, minimum size 40  */
char    cd[6],ce[6],cl[6],cm[16];       /* attributes, see termcaps      */
int     l_cd,l_ce,l_cl,l_cm;            /* lengths of attribute strings */
   /* add any or all of the enhancements you need from termcaps */

main()
{
    int i;

    i=open(termfile,0);     /* open termcaps file for read */
          /* loads current term file into buffer */
    if (tgread(i,term,1024) == -1)
          syserr("NO TERMCAPS ENTRY!!\n); /* ERROR */
    close(i);               /* done reading, close file */
          /* get enhancement strings and their lengths */
          /* tgstr() returns integer=length of string  */
    l_cd=tgstr(term,"cd",cd,6);     /* insert value of cd into  */
    l_ce=tgstr(term,"ce",ce,6);     /* string cd and set length */
    l_cl=tgstr(term,"cl",cl,6);     /* equal to the no of bytes */
    l_cm=tgstr(term,"cm",cm,16);    /* in the string            */

                    /*      BODY OF PROGRAM  */
```

The left argument is the length of the corresponding string, e.g., for CROMEMCO terminals which use:

cm = "\EF% + % + ''

as the cursor string, l_cm will be 8 bytes, since \E is the escape

character 0x1b. Note, the null character at the end of the string is not counted.

To clear the screen type:

```
wrseq(STDOUT,cl,l__cl);
```

The values of boolean and numerical values may be found by functions similar to tgstr: tgbool, and tgnum.

With the screen home position at (0,0) — the upper right corner, to set the cursor at row 5, column 20, first convert the cursor string to corresponding output bytes, then output the string:

```
l__cm = tprint(buff,cm,5,20);
wrseq(STDOUT,buff,l__cm);
```

I prefer the upper left-hand corner to be (1,1) so it is simple to write a cursor function:

```
cursor(x,y)
int x,y;
{
        int     len;

        x--;            /* to compensate for the 1 offset */
        y--;
        len=tprint(buff,cm,x,y);
        wrseq(STDOUT,buff,len);
}
```

So you can see that the function tprint will convert the cursor movement string to the proper output bytes. This corresponds to the UNIX function tgoto() but with more power since it can also convert positions for the invisible cursor, if you use CROMEMCO terminals, or any other function which uses parameters.

Two items of import are noted from the previous discussion: the functions tgstr and tprint both return the length of their corresponding strings, with -1 produced in case there is an error, like absence in the termcaps file for the desired attribute. Also, to send the string to the terminal, notice that wrseq is the preferred method in order to guarantee that the entire string is sent as characters to the screen.

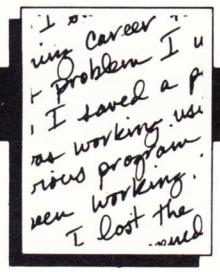
With very little effort on your part, you may write, as I do, terminal independent software for CROMIX.

One more note: many of today's terminals support reverse and underline attributes. Add to the termcaps file, near the bottom, so, se, us, ue as defined in the full termcap file. If you use COBOL or INFORMIX (a super product) you already have the complete package. If not, call me and I will give you those lines for your terminal if it is listed in the termcap file; otherwise, read the manual like the rest of us and write your own entry!!

We're Interested!

We're Really Interested...in what you have to say. Especially about how you use your system...the problems encountered and the solutions effected...unusual uses or environments...and any practical applications you would be willing to share with fellow members. These can be short notes for departments like 'bits & bytes...' and 'Tec Tips,' or full feature articles.

Contact Bill Jaenicke at I/O News for editorial guidelines or assistance. We're interested in unleashing your literary talents.



USER NOTES

USER NOTES are useful techniques, tips, ideas and other helpful information gleaned from our member's experiences with their Cromemco systems. If you have something along these lines that you want to share, write it up and send it to I/O NEWS, c/o USER NOTES, PO BOX 17658, IRVINE, CA 92713.

Editor's Note:

Thanks go to Colin "Soup" Campbell, *owner of Soup's Electronics in Fairbanks, Alaska, for his contribution to this issue's USER NOTES.*

TERMCAP

With Unix evolving into a standard some of the features already accepted by others become important. No longer is desktop independence profitable or even desirable. One of the features from Berkley is a system called termcap. In my search for information on termcap over the last year, this is a summary of what I have found.

Termcap: A system developed to keep programs from becoming device dependent.

Why:

Unix programmers, computer guru's, hackers, and other non-business people resent maintenance programming and reinventing the wheel dependent upon hardware availability. Therefore, to make applications programs more transportable, a system was developed to read terminal characteristics into a program from a data base of TERMinal CAPabilities.

To resolve file naming conflicts Unix stores user dependent information in .profile. The dot (.) in front of profile makes the file invisible for normal directory listings. INFX-D uses ../.env to store values in, but no matter, as long as your local getenv() function looks in the right place all the rest of the library needs not be changed.

SAMPLE .env

TERM C3102
TERMCAP /etc/termcap

By storing this in ../.env an application will search file termcap in directory /etc for the attributes of the terminal named C3102.

Changing it to :
TERM C-10
TERMCAP /etc/termcaps

will allow the application package to search the termcaps file in directory /etc for the attributes of the terminal named C-10.

How:

Given a database which contains various terminal capabilities, and knowing the structure of the database, what is needed is a set of functions which can access the database and extract the pertinent information for any given terminal. When writing applications programs for UNIX these functions are used to set internal variables used by the program to control such capabilities as cursor positioning, clearing the screen, and video attributes such as reverse video, underlining, and so on. Functions for accessing the termcap file would include the following:

getenv(LABEL)

getenv searches the environment list for a string of the form LABEL VALUE and returns a pointer to the value in the current environment if such a string is present, otherwise a NULL is returned.

In the above case:
getenv("TERM") returns C-10
getenv("TERMCAP") returns /etc/termcap
getenv("PRINT") returns \0

tgetent(buf,p)

tgetent loads the buffer buf with the termcap entry associated with the object of pointer p.
ie:

```
p = getenv("TERM");
tgetent(buf,p);
```

at this time buf will contain all the information associated with C-10 in file /etc/termcaps

tgetnum(id)

tgetnum gets the number associated with id.
ie:

```
CO = tgetnum(co#) /* get number of columns in a line */
```

tgetflag(id)

tgetflag gets the flag associated with id.
ie:

```
BS = tgetflag(bs) /* can backspace with ^H */
```

returns 1 if capable, 0 if not.

tgetstr(id,area)

tgetstr gets the string associated with id.
ie:

```
char *CL;
CL = tgetstr("cl",&buf);
printf("%s",CL); /* clear screen */
```

tgoto(CM,destcol,destline)

tgoto positions the cursor at the position destcol, destline. If not capable, OOPS will be written to the screen: check .env and termcap file.

The following sample program illustrates how these functions might be used in a UNIX application program:

```
char *p;
char *x;
char buf[512];
char *CL,*CM,*UP,*BC;
int CO,LI;
char HC;

main(){
p=getenv("TERM");
tgetent(buf,p);
p=buf;
CO=tgetnum("co#");              /* Number of Columns */
LI=tgetnum("li#");      /* Number of Lines */
CL=tgetstr("cl",&x);    /* CLEAR SCREEN */
CM=tgetstr("cm",&x);    /* CURSOR MOTION */
UP=tgetstr("up",&x);    /* UPLINE (cursor up) */
BC=tgetstr("bc",&x);    /* BACKSPACE */
HC=tgetflag("hc");      /* Can backspace with ^H */

if (HC)
        printf("\0x12");        /* form feed */
else
        printf("%s",CL);        /* Clear Screen */
printf("%sat 10,10",tgoto(CM,10,10));
printf("%sat 10,15",tgoto(CM,10,15));
printf("%sCENTER",tgoto(CM,(CO-strlen("CENTER"))/2,LI/2));
exit(0);
}
```

I hope this is of help; I know I have paid dearly in long hours, and long distance phone calls. Next issue—Curses—The next step beyond Termcap.

THE HACKER'S HOME

THE HACKER'S HOME explores techniques in 'C' programming for Cromix and UNIX. Users are encouraged to submit utility programs of their own. It is edited by **Rick Dhaenens**, Senior Manager for the **Cromemco, Inc.** Atlanta Regional Office, 5901-C Peachtree Dunwoody Rd, Suite 375, Atlanta, GA 30328. (404) 391-9433.

What More Memory Can Do For You

Back in the early days of microcomputers 256 bytes of memory was considered to be of significant size. This was mostly due to the size of available RAM chips. With the currently available 256K and 1024K bit memories today's super-micros have the ability to use up to 16 megabytes of memory. The Motorola 68020 32 bit processor can even address over 4 gigabytes of memory. This is a far cry from the first micro-based systems available in the mid-seventies.

The first Cromemco systems were based on the Zilog Z-80 microprocessor. The Z-80 could address up to 64K bytes of memory and using Cromemco's 4KZ memory board a system could be configured with the full 64K of memory. The 4KZ was the first S-100 memory board that had bank select switching. This meant that you could put more than 64K of memory in a system. With more than 64K of memory many things were possible, but all of them required software to select the different banks of memory. This software did not exist except in special applications software that was custom written.

Memory continued to grow and shortly thereafter the 16KZ memory board appeared. The 16K memory size was very popular because it was then possible to put much more memory into a fixed-size bus. With this new ability general purpose software was written to bring the power of more memory to the user.

The first example of this kind of software was Cromemco's Multi-user Basic. Multi-user Basic was a combination of a multi-user multi-tasking operating system and a programming language. Multi-user Basic required a minimum of 64K of RAM and 32K of memory for each user. This meant that using 16K memory boards a system only had to use 6 memory boards to acheive a multi-user environment.

Memory technology was quick to advance to 16K bit chips. These chips made possible Cromemco's 64KZ memory board. This board was the staple for most systems using Cromemco's CDOS, Multi-user Basic, and (the latest addition) Cromix operating systems. CDOS only needed 64K of memory, therefore a single memory board was all that was required. Multi-user Basic and Cromix could use up to seven 64K boards. This was pretty much the limit of what could be done with the Z-80 processor using Cromemco's bank select scheme, but was still considerable! Z-80 Cromix supported up to 6 users with 7 memory boards.

Alas, there was more to keeping the end users happy than just supporting more users. Each user in this environment was still limited to 64K of RAM for his programs. This was not such a problem for wordprocessing, and simple accounting programs because these types of programs were written to fit into small amounts of memory, but for scientific, engineering, and large data bases 64K was not enough.

Memory technology was getting better but the next jump had to be in the processor. At the time there were very few choices for better processors. One of the choices was the Intel 8086 processor. This processor was a little better than the Z-80 because it had extended addressing. Extended addressing allowed more memory to be addressed but the limit on contiguous memory was still 64K bytes.

Motorola's 68000 processor was also becoming available and it seemed to be a much better choice for a processor because of the 16 megabyte unsegmented memory address range. This large memory area made possible the development of programs that required more than 64K bytes of memory without resorting to software and hardware tricks.

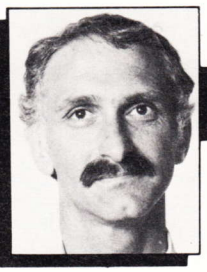
Until this point more memory would only buy more users, but with the ability to use more than 64K bytes of memory directly and the decrease in memory cost due to the new 64K bit memory chips, software design took a different turn. The software development efforts had been concentrating on providing the functionality of large memory arrays even in a bank selected environment. With the removal of the 64K byte limitation software development turned to providing more speed.

There are always tradeoffs in engineering, and software engineering is no different. Speed can be gained at the expense of memory in many applications. Larger buffers for all I/O can increase throughput by a surprising amount. The push was on, more and more uses were found for the abundance of memory that technology had spawned.

This brings us up to current day technology. 256K and 1024K bit devices make possible 2 megabyte memory boards, and systems with up to 16 megabytes of memory. This is memory that you can use to improve your system's performance.

Cromemco's Cromix-Plus and the AT&T UNIX System V operating systems can be configured to take advantage of the large amounts of memory that can be put into systems today. This memory can be used for expanded I/O buffers, RAM disk, shared memory, hash tables, and many other things to increase the speed of your system.

If your system is slower than you like check with your dealer and find out how much improvement you can get with a little more memory. It may save you more than it costs.



C-10 ENCOUNTERS

C-10 ENCOUNTERS is a regular column directed to users of Cromemco's personal computer, the C-10. It is edited by Dr. Tom Beer, of Applied Environmetrics, located at 118 Gordon St., Balwyn, Victoria 3103, Australia. Dr. Beer can be reached by phone during business hours at (03) 817-2571. Submit editorial directly to Dr. Beer.

Random Musings

As my incoming mail over the last few months has been unusually light I thought that I would devote this column to a few personal anecdotes and thoughts on personal computing. In addition to running *Applied Environmetrics*, I work as an environmental consultant and advise clients on the most cost-effective way of obtaining, and subsequently analyzing, meteorological and oceanographic data.

Every situation is unique and handled differently. In December 1984 I undertook an interesting job for the Shanghai Environmental Protection Bureau that involved the deployment of current meters, to measure the flow of the Yangtze River, and the installation of a Cromemco C-10 computer to analyze the subsequent results.

The reason for my spending a number of very pleasant days on a small survey ship positioned just southeast of the main shipping channel was to install an array of three current meters. Their data were to be used to examine the likely environmental impact of liquid wastes discharged into the Yangtze, which is nowadays called the Chang Jiang, from a proposed wastewater pipe. The Chang Jiang, meaning Long or Great River, is one of the largest rivers of the world. It has a catchment area of 1.92 million square meters, and its mean flow of 28,500 cubic metres per second ranks it as number four. For the last 100km of its flow, the river passes through a flat delta consisting of lakes, tributaries and canals connected with the main channel. At about 50 kilometres from the mouth the river begins to branch into a series of channels and passages separated by large cultivated islands and many shifting sandbanks. Maximum river depths in this area are over 30m but depths near the mouth are less than 10m due to the formation of bars from the river's vast sediment load. The Chang Jiang is a major transportation artery which plays a chief role in the development of Chinese commerce. It provides access for large ships to inland ports over a thousand kilometres from the river mouth. The Huangpu River, on which Shanghai is situated, flows into the Chang Jiang at Wusong Kou.

There are unique problems in measuring the current flow in a large river, with a lot of shipping activity, and with a very large tidal range. Chang Jiang River current meters were moored from a large light ship normally used as a navigation buoy. Data analysis of the retrieved current meter data tapes was done with a pre-programmed Cromemco C-10 computer with two disk drives.

Data Requirements

Estuarine variables that need to be monitored to provide data on the likely fate and environmental implications of the discharge of liquid wastes from an outfall are:

- Vertical density profiles
- Current
- Lateral dispersion.

The density of water is determined by temperature and salinity and, in the case of the Chang Jiang River, by its sediment load.

Current-Salinity-Temperature

Aanderaa RCM4S current meters were chosen for the collection of the requisite current, salinity and temperature data. These are cost-effective, proven and reliable instruments that are the work-horse of oceanographic investigations. The current meter internally records information at a predetermined sampling rate on current speed, direction, and temperature with salinity and depth (inferred from pressure) as options. The recording system consists of quarter-inch reel-to-reel magnetic tape with the information coded into ten-bit binary words. The magnetic tape can store 10,000 samples on 600 feet of magnetic tape on three inch reels. For a typical long-term estuarine sampling program which records information every ten minutes this offers a theoretical autonomy of 69 days. In practice, monthly servicing of the meters was carried out because *i)* the occasional battery will not last two months and *ii)* the rotor and vane need to be checked for fouling.

Data Analysis

To obtain information from the collected estuarine data, a dedicated data base management scheme was established using an Australian built electronic digital tape reader unit and a Cromemco C-10 personal computer. The C-10 is menu-driven and the menu choices are displayed in Table 1.

TABLE 1
Menu of Data Analysis Functions

SHANGHAI LIQUID WASTE DISPOSAL ** MENU OF FUNCTIONS:
ESTUARINE HYDRODYNAMICS PROGRAM ** DATA ANALYSIS

1: Help
2: Read in current meter data from Aanderaa tape reader
3: Generate a work disk of current meter data
4: Display current meter data listing on the computer screen
5: Print current meter data
6: Plot current meter data as time series or progressive vector plots
7: Plot vertical profile data
8: General purpose plotting program
9: Display more of the menu
10: Copy to or from an IBM-PC disk (PC-DOS 1.00 and 1.10 only)
11: List filenames of files on the currently selected disk drive
12: Copy a disk file
13: Copy a whole disk for backup on a blank disk
14: Check disk
15: Compare the disk in drive A with the disk in drive B
16: C-10 Self-test
17: Initialise a new disk (to be run before reading in a new tape)
18: Display Main Menu

The C-10 was chosen as the computer system to control the data reading and data analysis for the following reasons:

- Superior performance/price ratio
- Inbuilt communications capability through the UART which comprises a Synertek 6551 chip. Thus no hardware modification was necessary to the C-10.
- The on-off button is in a hard-to-find location so that casual tampering or playing with the machine is discouraged.
- The machine and operating system are little known, or so it was thought, which act as further deterrents to casual play-

ing with the machine.

• I knew a lot about it so that I could fix any bugs.

The information from the current meter tape is read into the C-10 and stored, in binary form, on floppy disk. Because of the relatively long disk access time a handshaking protocol between computer and tape reader was necessary, so as to buffer the input whilst a disk write was in progress.

The disk of raw binary data is transformed to scientific units via menu choice number 3, which reads the binary data off the disk in drive B and produces an ASCII file of date, time, current speed, direction, salinity, temperature, density and depth on a new disk inserted in drive A. The program offers helpful prompts and waits until each step has been successfully completed before proceeding to the next one. The C-10 has an RS232 output port and it is possible to simultaneously connect a printer and plotter to this single port by using a parallel connection for the printer and a serial connection for the plotter. Separate pins are used for both connections so that both sets of wires can run from the same plug. Typical graphical output from the plotter is depicted in Figure 1. The choice for the printer was a Texas Instruments TI850, which has a reputation for rugged reliability and the plotter choice was a Graphtek MP1000, a cheap yet extremely versatile machine.

When I arrived in Shanghai I thought that the Cromemco computer would be unfamiliar. I was wrong. My work was part of a much larger study of the Shanghai Urban Area and the traffic section were already using both a C-10 and a System 2 machine. Mr. Xu Hao of the Shanghai Transit Company pointed out that Cromemco is very well known and many of the manuals had been translated into Chinese in a six volume series. He presented me with volume number six of these Chinese language Cromemco manuals, published in 1983, as a souvenir. As I do not read Chinese I can only hazard guesses as to its con-

tents. However, as the words Cromemco LISP, Cromemco C, and (Overlay Linker) can all be found in the table of contents I think my guesses would be fairly accurate.

Hong Kong

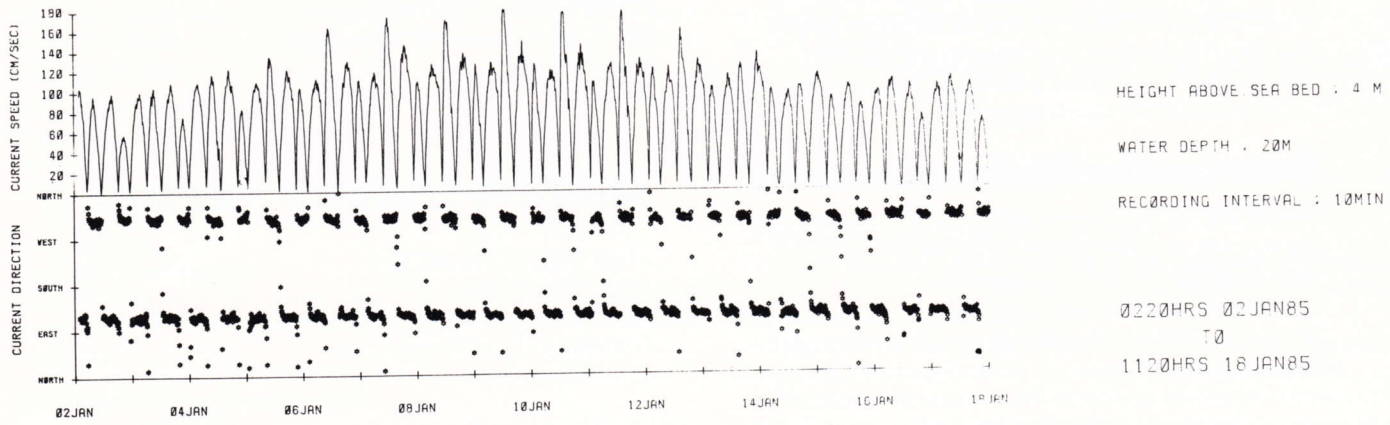
On my way back from Shanghai I stopped in Hong Kong. To a casual tourist the computer prices in Hong Kong do not seem particularly cheap, which reflects the fact that most reputable brands are manufactured elsewhere and imported into Hong Kong. However I had been advised to visit the Golden Shopping Centre at 156 Fuk Wah St. in Kowloon. You get there by taking the underground railway to Sham Shui Po and taking the forward (north) left exit from the station. In August 1985 when I went the first time there were two and a half floors of small shops selling AppleII and IBM-PC copies, pirated software for those machines and cheap Taiwanese reprints of computer books. No CP/M software at all. Nine months later when I revisited, the computer shops occupied only one and a half floors and the shops that remained sold only IBM-PC software and IBM-PC compatibles.

The developments in the Golden Shopping centre make me lament more than ever that Diskmaster—even in Release 2—supports only the very early version of PCDOS. Given that the IBM-PC under PCDOS 2 has become the de facto microcomputer standard, the inability of the C-10 to easily communicate with the IBM-PC is disastrous. I know that it can be done. Alan Miller of the CSIRO Division of Mathematics and Statistics sent me a Fortran program that allows his Cromemco machine to read and write IBM-PC disks, and this information could be used to setup a new disk type under Diskmaster 2. However this hardly qualifies as easy communication.

Disks

To the untrained eye an IBM-PC disk looks just the same as a Cromemco C-10 disk. They are both 5.25 inch double sided double density magnetic disks. The differences become apparent when the disk is initialized. This is done as the first part of the C-10 Copydisk program and consists of the machine sending write commands to the floppy disk controller chip (the FDC). Information on the disk is stored in sectors and each sector has a header, which tells the floppy disk controller which sector it is dealing with. Each sector is also followed by a checksum so as to ensure that read and write operations are being carried out correctly. The header and checksum are of relevance and of interest only to the FDC.

The Cromemco C-10 uses 512 byte sectors and puts 10 of them onto a track, with 40 tracks comprising each side of the disk. The disk thus holds 400K of information—though 40K is used up with the boot track and the directory leaving 360K free for the user. PCDOS 1 used 8 sectors per track and PCDOS 2 uses 9 sectors per track. Thus reading and writing IBM disks is, in principle, not a problem as long as one sends the correct signals to the FDC, which on the C-10 is a WD1793-02 controlled by ports 20h to 23h. The C-10 Technical manual does not give enough information on the signals expected by the FDC and so I got hold of the Western Digital FD179X-02 information manual and application notes. These succeeded in confusing me even further and in desperation I asked Alan Miller for some help and he was kind enough to send me his program to show how it is done. **I/O**



Optimizing UNIX

Continued from front cover

ed increasing demands on its host hardware.

In developing our latest generation of 68020-based systems, we identified three areas of computer hardware design which were given special attention to assure the implementation of a system that was unusually fast and responsive in the UNIX environment. These are the areas of disk data transfer, CPU performance, and system I/O.

Disk Data Transfer

UNIX makes heavy use of the system hard disk in transferring information to and from RAM memory. The reasons for this, quite simply, is that system RAM memory is more expensive per byte than is rotating disk memory. As a result, information not currently in use is swapped out to the hard disk, and retrieved when needed. The speed at which the system can access the information on disk, then, is extremely important. This is particularly the case with virtual memory, which is supported by the new Cromemco systems. Surprisingly, though, while there has been a substantial increase in hard disk storage capacities over the last few years, there has been little or no corresponding increase in the transfer rate of information to and from hard disk (which is typically in the range of from 5 to 20 megabits per second). With storage capacities increasing, and transfer rates staying relatively constant, new approaches must be taken to assure that system performance is not unduly compromised by the hard disk access speed.

One approach to this problem is to increase the amount of system RAM. As RAM prices have dropped, it makes more and more sense to keep larger amounts of information ready and waiting in RAM, and thus minimize the number of disk accesses required. In our own software development group today, the minimum-sized UNIX system in use has 4 megabytes of RAM, with 2 megabytes assigned to the system, or "kernel," and 2 megabytes as user area. This is quite an improvement over the 24K system used for UNIX development by Thompson and Ritchie! In fact, one of the nice enhancements of Unix System V over previous versions is in its ability to configure with a large kernel.

Another approach to speeding hard disk access can be found in the design of intelligent hard disk controllers with cache memory. Our STDC controller card, for example, has a four-track cache to keep resident the information from the four most recently accessed tracks on the hard disk. Since most information is accessed sequentially, this means that many requests for hard disk information can be filled from information already in cache, without the relatively slow access of the hard disk being involved. Measurements we have made show that typical times to load information from hard disk can be decreased by a factor of four with this technique. Multiple STDC cards can be used in a Cromemco system with multiple hard disks to provide a separate 4-track cache for each disk drive.

CPU Performance

Since UNIX is a time-slice operating system with multiple tasks typically sharing a central processor, CPU performance can be the limiting factor in determining how many users, or tasks, can be accommodated by a given system. There have been a number of innovations in CPU design that have made high-performance UNIX hardware increasingly accessible.

First of all have come advances in microprocessor technology, both in terms of increased data path width and reduced cycle times. From the 8-bit processors operating at 2MHz of a few years ago, we now can enjoy 32-bit processors, such as the 68020 operating at 16.7MHz, that is used on the new Cromemco XXU processor card. Not only are the processors faster, they're smarter too. The 68020, for example, has an on-board look-ahead instruction cache to anticipate and expedite the sequential instruction flow.

These new higher performance CPU's can also be augmented to substantially increase the processing power. One way this is achieved is by use of specialized co-processors. The 68881 floating-point co-processor, for example, is a specialized 80-bit wide processor that can perform extremely fast math operations. Benchmarks have shown that the 68881 processor can actually perform operations 6 to 7 times faster than the 80287 co-processor commonly found in small personal computers. A 68881 processor operating at 16.7MHz is included on the Cromemco XXU card. Special microcodable co-processors, such as the Cromemco Maximizer, are also available which can be dedicated to special applications, such as geometric transformations in a graphics system.

Memory management is particularly important in a UNIX system in that it provides user security and protection. Since UNIX is a time-slice system, the speed of memory mapping is absolutely critical. Some of the early LSI controller chips were extremely slow, and computers using these chips, such as the Motorola 68451, were just not suitable for the UNIX environment due to their slow multi-user response time. As a result, specialized memory management hardware has been developed, such as the Cromemco XMM and XMU cards which can provide context switching in a single instruction time.

While processors such as the 68020 do have an on-chip instruction cache, manufacturers of high performance UNIX systems are supplementing that with external instruction and data cache. The Cromemco XXU has an unusually large external cache, a full 16K bytes of high speed, static, CMOS RAM.

To quantify the importance of cache memory to the enhancement of CPU performance we ran a set of experiments on a Cromemco System 420 with and without the 68020 on-chip cache activated and with and without the 16K of off-chip cache activated. To test system performance under these four experimental conditions we ran the industy standard Whetstone benchmark suite. The results were, with both cache memories de-activated, a performance measure of 600,000 Whetstones per second. With on-chip cache only activated performance increased to 850,000 Whetstones. With 16Kb of external cache only, performance increased to 970,000 Whetstones. With both on-chip and external cache activated performance increased to 1,050,000 Whetstones. This translates into a substantial 75% speed improvement in a 68020 based system through the use of cache memory.

I/O

While many benchmarks measure the internal speed of computer operation, it is also important that the computer is able to input and output information in a timely fashion. Particularly in a multi-user environment, the speed of CRT screen updates can be unacceptably slow if UNIX is not given some hardware assistance with this task.

The most effective method we have found to assist UNIX with this task is through the use of FIFO (first-in first-out) cache buffers in the I/O path. Our experiments have shown that the

optimum-sized buffer for a CRT terminal is one that contains a complete screen full of information. For an 80x25 character display, this corresponds to a 2K byte buffer. UNIX then is free to read or write this buffer without concern for artificial peripheral speed limitations. Experiments that we carried out with our Octart card, which provides 2K of FIFO buffers for each of 8 input and 8 output channels, showed that overall I/O throughput was increased by a factor of 8 compared to the performance without FIFO buffers.

Summary

Not all hardware systems are equally adept in the UNIX environment. By using cache in the CPU, disk, and I/O data paths the new generation of XXU-based Cromemco systems are unique in their "triple-cache" design. In addition, the support of large amounts of RAM memory, fast memory management, virtual memory, and co-processor support all contribute to unusual levels of performance in these systems.

Series 40 Cromix

Continued from front cover

tion directives; otherwise the two series have identical source. One of the main benefits of this approach is that Cromix-Plus Series 40, though technically a "new' operating system, is actually as thoroughly tested as Cromix-Plus Series 30.

Another benefit of the side-by-side development of Cromix-Plus 30 and 40 series is in upward compatibility. Series 30 utilities and other programs can be run under Series 40 without modifications, using the 68000-compatible mode of the 68020. Of course these 30-series programs will not take full advantage of the 68020 processor and the 68881 floating-point co-processor; for this it is necessary to recompile each program with a proper 68020 compiler. Such recompiled programs can then be used to full advantage with Series 40.

Since the initial version (31.06/40.06) was created in September 1985 a number of substantial improvements have been made in the twin system. Here are the most important changes and improvements:

Memory Protection

By far the most important change was the addition of memory protection. Cromix can now use an XMU memory management board if one is present and software-enabled. With the XMU turned on it is not possible for a user to crash the system as the result of faulty code, since any reference to system memory (or memory of another user) will be detected and defeated by the XMU hardware. Cromix-Plus will then kill the offending process.

Shared Code

In the process of implementing memory protection a number of other changes had to be made. For instance, the Gtty and Shell routines were removed from the Kernel and reduced to legal user programs. This in turn led to the development of a shared code concept, in which all users use the same copy of code and each user gets its own data on the stack. Now, the Gtty, Shell, and certain other parts of the system are legal user programs that can be shared.

Every user can write his own shared programs in the style of Gtty and Shell utilities. The rule is quite simple (simple to state, may not be so simple to adhere to): A shared program can never write to static memory. In terms of the C language, static variables can be used only for reading. Stated another way, all true variables must be automatic (on the stack). If the XMU is enabled it will catch all violations of the above rule. Once such a program is created the Access utility can be used to declare it as Shared (the ls -l utility will show it as such). After this it may be executed as any other program. Note also that Cromix-Plus now has a sysdef entry limiting the number of shared texts; you may wish to increase this value as you add your own shared programs.

Inter-Process Communications

In response to requests from the Cromix community, **Inter-Process Communications (IPC)** were introduced. The Inter-Process Communications mechanism consists of three components: message queues, shared memory, and semaphores.

For each of the IPC facilities one user is supposed to create such a facility, and the other users are supposed to gain access to it. In the case of message queues a process can send a message to the message queue, another process can pick up the message when needed. It may choose to sleep until an appropriate message is deposited by some other user. In the case of shared memory, one process can create it, another process can gain access to it and so two (or more) processes can communicate with each other. For shared memory to be useful some kind of handshaking mechanism is required. A message queue can be used for that purpose, or a general semaphore mechanism which is the third component of the IPC.

Two utilities go with the IPC mechanism: Ipcs and Ipcrm. Ipcs acts like Pstat — it lists the current state of IPC facilities. The Ipcrm utility can be used to remove an IPC facility thereby waking up all processes that are sleeping and waiting for something to happen. The processes will be told that the IPC facility has been removed.

Improved CE Editor

The ce editor that was first released with the 31.05 version of Cromix-Plus has been greatly improved and expanded. Among the new features are a keystroke log and several "two-dimensional" text manipulation commands. The keystroke log records all operator input, and may be fed into the editor to re-create the previous editing session. This feature could even be used as a generalized form of an "undo" command. The new text-manipulation commands allow the user to insert, delete, or move rectangular areas of

text. Thus it is possible to move and interchange columns of text (as often found in spreadsheet data, assembly listings, etc).

Termcaps

Cromix-Plus now maintains the /etc/termcaps file. This data file, which can be edited if necessary, describes the capabilities of a number of different terminals. Every process knows what type of terminal the user's standard input is connected to. The initial terminal type may be defined by a Shell command or stored in the /etc/ttys file to be loaded automatically when the Shell process on the terminal is started. Subsequent processes inherit the type of terminal from their parent process. The file /usr/lib/syslib.obj, the library of C callable functions, contains functions to read and decode the /etc/termcaps file. There are a number of utilities (Shell, ce, help, more) which use the terminal description from the /etc/termcaps file. The net effect is that such utilities work on any kind of terminal and can take into account any unusual capabilities the terminal might offer.

Command History

The Shell retype mechanism (Control-R) has been greatly improved and extended: each interactive Shell now keeps a history of executed commands, which may be listed by the History intrinsic, and selectively repeated via Control-R. As before, whenever the user types Control-R the last command is redisplayed and can be edited before it is executed. If the Control-R key is preceded by a number, however, the command with that number in the history list will be redisplayed for editing or execution. This mechanism is always enabled and can be used on any type of terminal.

New Debugger — DDT

With memory protection now a part of Cromix-Plus, the old Debug68 program has been retired. Previously, Debug68 would modify the kernel code in order to install the trap handling routines. The results were that only one user could use Debug68 at a time and if debugging was aborted the system was left in a polluted state. The new ddt utility is a modernized version of Debug68, which uses the __ptrace system call to handle the tracing and trapping. Now a perfectly legal user program, ddt forks the debugged process in traced mode so that ddt and the debugged program execute as two different processes which interact with each other. Ddt commands can be used to inspect and replace user memory and user registers, to handle user signals, and many other functions. Ddt fully understands both 68020 and 68881 instruction sets.

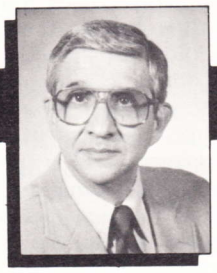
Expanded Help Files

In response to a number of requests, Cromix-Plus includes a number of new help files. These cover not only the new utilities but also the description of all system calls, both from the assembler and from C. The on-line manual ensures that the documentation is always at the programmer's fingertips.

Explore it Yourself

There are many more developments in the new Cromix, but space prevents listing them all. But you'll have fun exploring the new Cromix for yourself!

CD



32K CLASSROOM

32K CLASSROOM is a regular column aimed at explaining programming techniques using Cromemco Structured BASIC. It is edited by Bernie Thomas, President of Jakes Manufacturing Corp., P.O. Box 23050, Nashville, TN 37202. Submit any editorial contributions to I/O NEWS in care of the 32K CLASSROOM.

This will be a potpourri of things which people have called and written about, but which by themselves would not be long enough for an article. Before I do that, however, I would like to describe a problem in the hopes that someone who reads this may have the solution. The problem is with the No Escape. Ever since version 11.16 of Cromix, No Escape has not functioned properly. For those who may not know it, No Escape is important for two reasons. It obviously prevents a user from escaping your program either intentionally or accidentally, but is also causes a program to run faster. The problem, however, is that when the No Escape is invoked and an ESCAPE is given, the symbols ^[and a line feed are sent to the screen. This creates many problems, particularly if you use graphs which replicate forms from user input. I have tried changing all the various modes such as crdev, but nothing solves the problem. I have called Cromemco many times over the past two years or so, but no one has been able to help. Even such reliable sources of help such as Rich Quinn and Norman Miller could not help. If anyone who reads this has the answer, please call me at 1-800-251-2590. I would be very and forever grateful.

Several people have asked me about Data, Restore and Read. They are not fully explained in the manual, and I can see where a beginner might not understand their full use. The following is a very easy to understand and useful example. The purpose of the routine is to convert a date such as 860704 to July 4, 1986.

```
100   D$=Date$("")
110   Data"January","February","March","April","May","June"
120   Data"July","August","September","October","November","December"
130   Restore 110 : U=0
140     Repeat
150     U=U+1 : Read Month$
160     Until U=Val(D$(2,3))
170   @ Month$;" ";D$(4,5);", 19";D$(0,1)
```

Line 100 reads the system Date into the variable D$. You can also set the Date from Basic by saying Date$ = ("yymmdd"). Time can be read and set in the same manner using Time$. Line 110 is the beginning of our "Data Statement." Note that it does not have to be all on one line to operate properly. Line 130 Restores the pointer in our data statement to the beginning, and sets the variable U to 0. Line 140 uses the Repeat command. This means that the code between the words Repeat and Until on Line 160 will be repeated until the condition following the word Until is met.

Line 150 increments U by 1 and D$ becomes the corresponding month. For example, the first time this code is encountered, U becomes 1 and D$ becomes "January." The seventh time it is encountered, U becomes 7 and D$ becomes "July."

Line 160 determines how many times Line 150 will be repeated. If the date happens to be 860704, the Val of D$(2,3) will be 7, and the line will be repeated seven times and D$ will become July.

Line 170 will, of course, print the date.

Another problem which several people have asked about is common fractions. Trades such as carpenters, cabinetmakers, etc., are used to working in fractions, and cannot be expected to change to suit the inadequacies of a computer program. The following program adds common fractions by converting them to the decimal equivalent, adding them, and then converting the answer back to a common fraction. This example converts to the nearest 16th of an inch. The only rule which the user must follow is to input the number as 1-3/8, 2-15/16, etc. Every entry does not have to be a fraction. The program will add 2 plus 1-12 or 35 plus 65.

```
100   Data"1/16","1/8","3/16","1/4","5/16","3/8","7/16","1/2"
110   Data"9/16","5/8","11/16","3/4","13/16","7/8","15/16"
200   Input"Enter a Number (Ex: 1-3/16) >",Ent1$
210   P1=Pos(Ent1$,"-",0) : P2=Pos(Ent1$,"/",0)
211   If P1=-1 And P2=-1 Then C=Val(Ent1$) : Goto 300
212   Whole'number=0 : If P1>-1 Then Whole'number=Val(Ent1$(0,P1-1))
220   E=Len(Ent1$)-1 : A=Val(Ent1$(P1+1,P2-1)) : B=Val(Ent1$(P2+1,E))
230   C=Whole'number+(A/B)
300   Input"Enter another Number >",Ent2$
310   P1=Pos(Ent2$,"-",0) : P2=Pos(Ent2$,"/",0)
311   If P1=-1 And P2=-1 Then D=Val(Ent2$) : Goto 370
312   Whole'number=0 : If P1>-1 Then Whole'number=Val(Ent2$(0,P1-1))
320   E=Len(Ent2$)-1 : A=Val(Ent2$(P1+1,P2-1)) : B=Val(Ent2$(P2+1,E))
330   D=Whole'number+(A/B)
340   If C+D<1 Then  Do : E=Int((C+D)*16)
350     Restore 100 : U=0
360       Repeat : U=U+1 : Read Answer$ : Until U=E : Enddo
370   If C+D>=1 Then  Do
380     E=Int(Fra(C+D)*16) : F=Int(C+D)
385     If E=0 Then Answer$=Str$(F) : Goto 420
390     Restore 100 : U=0
400       Repeat : U=U+1 : Read Ans$ : Until U=E
410     Answer$=Str$(F)+"-"+Ans$
420     Enddo
500   @ : @ Ent1$;" plus ";Ent2$;" equals ";Answer$
510   Goto 200
```

You will note that this program again uses the Data statement. This time I have placed the Data statement at the beginning of the program just to demonstrate that it does not matter where it is placed. Most people work to the nearest 16th of an inch, but if you wish to work to the nearest 32nd then you would need to change the Data statement to read '1/32", "1/16", "3/32", "1/8", etc., and in Lines 340 and 380 you would change *16 to read *32. As always, I would appreciate any comments, and if you have anything you wish to contribute, please let me know.

NEW PRODUCTS...

NEW PRODUCTS is a regularly appearing column devoted to announcing and following hardware and software products of interest to Cromemco users. Most information is derived from press releases submitted by vendors. As a result, I/O NEWS cannot be responsible for errors of ommission or any other inaccuracies.

Sarah Jeanne

After years of research and nine months of development utililizing the most advanced biological productivity tools, *I/O NEWS* is proud to announce the completion of its most ambitious project to date. Designated **Sarah Jeanne Jaenicke**, this new fully automated unit came off the production line at dawn on July 20, 1986, and immediately passed all quality control tests administered by the technicians at Hoag Memorial Hospital in Newport Beach, California.

Specifications:

Weight — 6 pounds, 8.5 ounces.
Length — 21 inches.
Eyes — Blue.
Hair — Blond (what little of it there is).
Price — Priceless.
Available for shipment — July 20, 2004.

Sarah Jeanne currently holds the position of Entertainment Director, but is expected to make contributions to programming and editorial as a Cromemco user in the not too distant future. For further information contact Bill or Lisa at *I/O NEWS*.

Integrated Productivity Tools

SouthWind Software, Inc. has completed the port of its Integrated Productivity Tools, **TACTICIAN** and **GRAFSMAN**, to the Cromemco family of UNIX-based systems. TACTICIAN and GRAFSMAN provide an integrated spreadsheet and graphics solution that is interfaced with data base management systems (Informix, Ingres, Progress, and Unify) as well as word processors such as R Word and CrystalWriter.

TACTICIAN provides a 1024 x 1024 spreadsheet with features such as sorting, macros, flexible formatting, and a full range of financial, statistical, string, and date functions. The data base management interface allows the user to pull information directly from the data base into TACTICIAN for further analysis. The integration with GRAFSMAN allows the user to display spreadsheet information in a graphic format.

GRAFSMAN provides business presentation graphics on a wide range of output devices including character terminals, graphics terminals (both color and monochrome), pen plotters, dot-matrix printers, and laser printers. GRAFSMAN supports a variety of bar charts (horizontal/vertical, stacked/clustered, floating), line charts, and pie charts. There are no restrictions limiting the amount of text placed on a chart or the number of charts that can be combined into a single picture.

GRAFSMAN provides an interface to data base management

systems, making it easy to get at the data to be displayed. In addition, GRAFSMAN makes it possible to include these charts within a document at print time.

Integrated Productivity Tools are available from:

SouthWind Software, Inc.
4520 E. 47th Street South
Wichita, KS 67210
(316) 524-9100

New Intelligent Display Terminal

Cromemco's new **Model C-15** is an alphanumeric ANSI standard display terminal featuring a 14-inch non-glare screen with amber characters and 65 Hz screen refresh rate to help relieve eye strain. It has a detachable keyboard with separate numeric keypad and 16 function keys. Some advanced features include nine resident character sets to satisfy requirements in the USA, UK, France, Germany, Spain, Norway, Sweden, Denmark, and Italy. The display format is adjustable to support 132 or 80 column documents with either 24 or 48 lines per page. Split screen, auto paging, jump scrolling and smooth scrolling at 4 preset speeds are also provided. The standard configuration of the primary port is RS-232C, but the RS-422 interface is available for faster data transfer requirements. Other features and benefits include an ergonomically designed tilt-and-swivel display, 256 bytes of nonvolatile memory, special characters and line graphics, secondary port can interface with printer for screen output, and DEC-VT100 terminal emulation.

The C-15 became available for shipment in June; list price is $795.00.

The IOP-X

Cromemco announced their latest board in an already extensive line of board controllers: the **IOP-X I/O Processor Board**. The IOP-X offers performance above and beyond that of the IOP board by implementing 64Kb of on-board RAM rather than 16Kb. This larger RAM is useful for systems that require a large buffer during transfer of files from 9-track tape drives.

Except for the larger RAM, the IOP-X is functionally equivalent to the IOP board. Standard cables used to interface the IOP with a system remain the same.

T/H/C MAILLIST & LABELS

The **T/H/C MAILLIST** data entry program makes it easy to enter data into small data bases for mailing lists, price or product lists, personnel records, etc.

Features:

- Makes it easy to enter data for **T/H/C LABELS**, Micropro's Mailmerge, or any program which can make use of sequentially stored, carriage return delimited records with comma delimited fields.
- Define multiple data entry formats, each having up to 15 fields. Each field in an entry format file is defined by a field description, an entry prompt, the variable name used in Mailmerge documents, and the minimum and maximum lengths for the field. There is a default MAILLIST format which can be changed to match your most frequent use.
- Enter data in response to prompts which MAILLIST provides. Each entry is displayed after its field description on the screen.
- For any field you can load a default value (D =), enter the default value (D), or repeat the previous entry for a field (R).
- Check a data file to have the correct number of fields in each record after making changes with an editing program such as Micropro's Wordstar.
- Create a Mailmerge Master print control file called MMMASTER. Type MMMASTER after selecting Mailmerge from Wordstar's menu. You will be asked for the name of the document file, the data file, the Mailmerge format file (created by MAILLIST), and the date (optional).

Continued

New Products

Continued

• Create Mailmerge format files to define such things as printing pitch, top & bottom margins, and page (record) size. For instance you might want LETTER10 & LETTER12 for 10 pitch and 12 pitch letters.

• Select an entry format to use for your current entries.

• Display records from a data file using the current entry format.

• Display a helpful TUTORial file to gain familiarity with the program.

T/H/C LABELS

The **T/H/C LABELS** program provides superior label printing capabilities for users of small computer systems.

Features

• Multiple across labels (up to 10)

• Define labels from any combination of Serial Number, Fields from a data file, or text you enter during set up.

• Quick set up of label parameters including: Desired offset from printer's left margin; Number of labels across (up to 10); Label width (in characters); Label height (in lines); Number of printing lines on label; Number of copies of each label; Starting serial number (if used); Remove blank lines (vertical pack).

• Easy On-Screen definition of label printing lines

B selects Bold Printing
C selects Centering
F selects a Field number from a data file
R Repeats a previously defined line
S selects the Serial Number
T allow you to enter Text

• Name and save label formats for quick reloading

• High Speed printing

Both T/H/C MAILLIST and T/H/C LABELS are reasonable priced at only $75 apiece or both for $100. Available from:

The Hutchinson Company
200 W. 34th, #799
Anchorage, AK 99503.cen
(907) 337-6001

Editor's Note:

We've been using the MAILLIST and LABELS program (but without utilizing the Mailmerge capabilities) at the office and have found it extremely effective and flexible (drawing data from Informix databases and 32K SBASIC files). Look for a review next issue. Ed.

Graphic Interface for AMPEX Terminals

A230/GRAF is an additional option board for the AMPEX A230 and A219 Video Terminals which allows you to produce drawings with high resolution. This can be done in addition to other capabilities of these terminals. Both presentations — graphic and the standard alphanumeric — are mixed into one picture.

The commands to draw a vector are equal to the Tektronix 4010 commands. Additional commands allow the use of the terminal in one special application:

The A200/GRAF is excellently suited for all applications using special language character sets: these can be hebrew, proportional or "math." There can be 124 different symbols. These symbols are stored once in the interface and can be called with a single command. The only limitation is the number of symbols (124) and the total number of vectors (about 1500).

The A230/GRAF will also be available for the A220 with other firmware. The different models are:

• A230/GRAF-0 standard Version for A230.

• A219/GRAF-0 same board but different firmware for the A219 VT-100 compatible terminal.

• A220/GRAF-0 same board but different firmware for the A220 VT-200 compatible terminal.

• A210/GRAF-0 different board with firmware for the A210, only 300 lines.

The following technical description is for the A230/GRAF:

The terminal firmware has been changed so that all characters between GS (resp. ESC V) and US, CR or ESC FF are sent to the graphic interface. There they are transformed to an internal representation and stored into an input queue. This buffer provides space for 1024 coordinates or commands.

The graphic processor is a NEC 7220 controlled by its own Z80. This processor fetches instructions from the circular input queue and executes them after interpretation. The drawing speed is in peak times up to 300,000 pixels per second. Measured speed is significantly more that 1000 vectors per second.

The internal Z80 uses 16Kb PROM for local firmware including the character generator and also some custom pictures. One of these custom pictures is a world map used for demonstration and tests. Most pictures delivered in commands for the A230/GRAF can be adapted to EPROM storage. The 8K working storage can be expanded to 32Kbyte for bigger buffer and macro storage.

The resolution is standard 312 lines with 720 pixels each. This resolution can be changed by moving a jumper on the graphic board to 624 lines with 720 pixels each. This is done by running the terminal in interlace mode, giving very good results if a slower screen is used.

The lower left corner of the screen is the origin with the coordinate pair (0,0). The x-axis is horizontal and the y-axis is vertical. Therefore the coordinate of the upper right corner is (719,311) or (719, 623) if interlace is used.

The interface allows the user to define any addressable pixel as a new origin. That's necessary to define the location of symbols. The same symbol can be drawn at different locations on the screen if the origin has been changed between the single drawings. Besides this it is possible to save local buffer area: coordinate pairs with both numbers smaller than 128 are stored internally in two bytes instead of four bytes.

The graphic interface (Price: DM 800 or US $350) can be obtained via the following address:

Marketing Service GmbH
Osterwaldstrasse 10
8000 Munich 40
W. Germany

New Cromemco System 420 uses 32-bit, 68020/68881-based XXU processor.

The International Association of Cromemco Users

Software Resource Survey

— PURPOSE —

The purpose of this survey is to further expand the list of known software applications running on Cromemco systems. By taking the time to complete and return the questionaire you will be doing yourself and Cromemco users worldwide a tremendous favor. Everyone needs software, but finding the package you need can be terribly frustrating. This survey could eliminate that frustration. So please, help us help you by returning the completed questionaire at your earliest convenience.

Thank you!

— INSTRUCTIONS —

There are three (3) sections to this survey. Put your name and address information in the USER section. Use the SYSTEM section to describe the Cromemco system on which the software is run. If you have different systems running different operating systems and software, photocopy the survey sheet and submit one for each system.

The survey sheet has space for four (4) software package descriptions. If you have more than that, make some additional photocopies. For each package, provide the following information: the **product name**, a brief **description** of the software (spreadsheet, wordprocessor, DBMS, etc.); if you had **problems** in getting the package up and running, so indicate with comment; indicate whether or not you are satisfied with the package. Also, please provide the address and telephone information about the software **vendor** or manufacturer so that we can submit more detailed Product Fact Sheets to them. If the application was designed in-house, please make note of it and indicate if you're interested in having the application included in the **IACU Software Resource Guide**. If so, we'll send you some Product Fact Sheets.

When completed, please mail the survey sheets to:

The I.A.C.U.
P.O. Box 17658
Irvine, CA 92713

USER

Name _____ Member No._____

Address _____

_____

City _____ State _____ Zip _____ Phone _____

Country _____

SYSTEM

Model: _____

Memory: _____

Disks: _____

Operating System: ☐ CP/M ☐ CDOS ☐ Cromix

☐ Cromix-D ☐ Cromix-Plus ☐ UNIX ☐ Other_____

SOFTWARE

Product Name: _____

Description: _____

Problem? ☐ Yes ☐ No _____

Like it? ☐ Yes ☐ No _____

VENDOR INFO

_____

_____

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Product Name: _____

Description: _____

Problem? ☐ Yes ☐ No _____

Like it? ☐ Yes ☐ No _____

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Product Name: _____

Description: _____

Problem? ☐ Yes ☐ No _____

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UNIX System V, the new standard in multi-user microcomputer operating systems, gives you high performance features along with the portability and flexibility of a standard.

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